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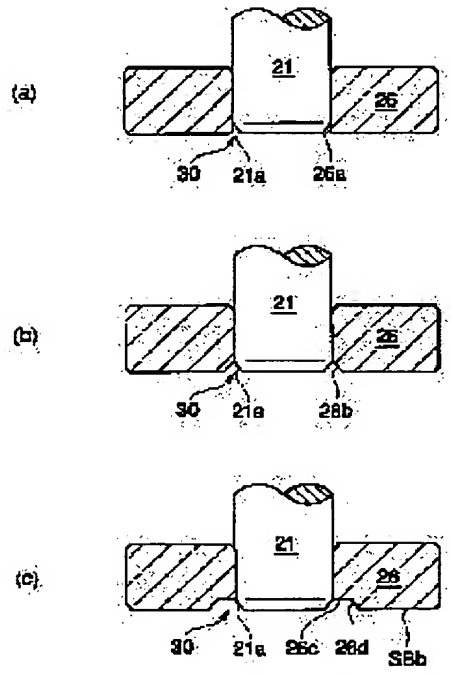
(54) SPINDLE MOTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To raise the junction strength between the fellow parts relatively short in junction length while thinning a motor, by providing the surface part of a junction boundary with an escape part sunken in axial direction, and welding a bearing sleeve and a counter plate in this escape part thereby uniting both.
SOLUTION: After press-fitting or insertion of a rotary shaft 21 and a thrust plate 26 on a level that the deterioration of squareness does not occur, the junction boundary between both is welded from the side of surface. At this time, an escape part 30 sunken in axial direction is made in circular form in advance at the surface part of the junction boundary, and in this escape part, the rotary shaft 21 and the thrust plate 26 are welded. For the form of the escape part 30 at the junction boundary between the rotary shaft 21 and the thrust plate 26, a taped face 21a is made all around the peripheral fringe on tip side of the rotary shaft 21, while the inside peripheral face 26a of the center hole of the thrust plate 26 adjoins the tapered face 21a.



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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The fixed frame which has a tubed attaching part, and the approximately cylindrical bearing sleeve which has dynamic pressure bearing and was attached in the inner circumference side at the above-mentioned tubed attaching part, The lubrication fluid held in this bearing sleeve, and the revolving shaft were inserted in the above-mentioned bearing sleeve and bearing of the rotation of was made free through the above-mentioned lubrication fluid, The hub which fixed to the end side of this revolving shaft, and the annular thrust plate which junction fixing is carried out at the other end side of the above-mentioned revolving shaft, and constitutes thrust dynamic pressure bearing, The above-mentioned bearing sleeve is equipped with the counter plate by which junction fixing was carried out so that opening of the above-mentioned bearing sleeve may be blockaded. While preparing the roll off which became depressed in shaft orientations, welding the above-mentioned revolving shaft and the above-mentioned thrust plate in this roll off and uniting both with the surface part of the junction boundary section of the above-mentioned revolving shaft and the above-mentioned thrust plate The spindle motor which prepares the roll off which became depressed in shaft orientations, welds the above-mentioned bearing sleeve and the above-mentioned counter plate in this roll off, and comes to unite both with the surface part of the junction boundary section of the above-mentioned bearing sleeve and the above-mentioned counter plate.
[Claim 2] The fixed frame which has a tubed attaching part, and the approximately cylindrical bearing sleeve which has dynamic pressure bearing and was attached in the inner circumference side at the above-mentioned tubed attaching part, The lubrication fluid held in this bearing sleeve, and the revolving shaft were inserted in the above-mentioned bearing sleeve and bearing of the rotation of was made free through the above-mentioned lubrication fluid, The hub which fixed to the end side of this revolving shaft, and the annular thrust plate which junction fixing is carried out at the other end side of the above-mentioned revolving shaft, and constitutes thrust dynamic pressure bearing, The above-mentioned tubed attaching part is equipped with the counter plate by which junction fixing was carried out so that opening of the tubed attaching part of the above-mentioned fixed frame may be blockaded. While preparing the roll off which became depressed in shaft orientations, welding the above-mentioned revolving shaft and the above-mentioned thrust plate in this roll off and uniting both with the surface part of the junction boundary section of the above-mentioned revolving shaft and the above-mentioned thrust plate The spindle motor which prepares the roll off which became depressed in shaft orientations, welds the above-mentioned tubed attaching part and the above-mentioned counter plate in this roll off, and comes to unite both with the surface part of the junction boundary section of the above-mentioned tubed attaching part and the above-mentioned counter plate.
[Claim 3] The spindle motor according to claim 1 or 2 characterized by for one of materials having fused at least in each above-mentioned junction boundary section, and having combined with the material of another side.
[Claim 4] The spindle motor according to claim 3 characterized by the above-mentioned hub and the above-mentioned revolving shaft having fixed by welding [Claim 5] the roll off which the slot for dynamic pressure generating is formed in the above-mentioned thrust dynamic pressure

bearing of the above-mentioned thrust plate, and was formed in the junction boundary section of the above-mentioned revolving shaft and the above-mentioned thrust plate is formed in the part from which it separated from the formation field of the above-mentioned slot for dynamic pressure generating -- the spindle motor according to claim 1 to 4 characterized by things.
[Claim 6] The fixed frame which has a hole for axial immobilization, and the fixed shaft by which the end was inserted in the above-mentioned hole for axial immobilization, and junction immobilization was carried out at the above-mentioned fixed frame, The bearing sleeve which has dynamic pressure bearing in an inner circumference side, and was fitted in the above-mentioned fixed shaft, The lubrication fluid held in this bearing sleeve, and the hub were constituted in one with the above-mentioned bearing sleeve, and bearing of the rotation of was made free through the above-mentioned lubrication fluid, It has the annular thrust plate which fixes to the other end side of the above-mentioned fixed shaft, and constitutes thrust dynamic pressure bearing. The spindle motor which prepares the roll off which became depressed in shaft orientations, welds the above-mentioned fixed shaft and the above-mentioned thrust plate in this roll off, and comes to unite both with the surface part of the junction boundary section of the above-mentioned fixed shaft and the above-mentioned thrust plate.
[Claim 7] The roll off which the slot for dynamic pressure generating is formed in the above-mentioned thrust dynamic pressure bearing of the above-mentioned thrust plate, and was formed in the junction boundary section of the above-mentioned fixed shaft and the above-mentioned thrust plate is a spindle motor according to claim 6 characterized by being formed in the part from which it separated from the formation field of the above-mentioned slot for dynamic pressure generating.
[Claim 8] The spindle motor according to claim 7 characterized by for one of materials having fused at least in the above-mentioned ********, and having combined with the material of another side.

[Translation done.]

JAPANESE [JP,2000-324753,A]

CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE INVENTION TECHNICAL PROBLEM MEANS DESCRIPTION OF DRAWINGS DRAWINGS CORRECTION OR AMENDMENT

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the spindle motor used as rotation driving gears, such as a hard disk. Furthermore, when it explains in full detail, this invention relates to the technique for improving the dependability of the spindle motor equipped with the hydrodynamic bearing.
[0002]
[Description of the Prior Art] As a spindle motor used as a rotation driving gear of record media, such as a hard disk, the spindle motor of a publication is known by JP,8-4769,A, for example. This spindle motor mainly consists of a stator group 10 attached to the frame 11, and a Rota group 20 equipped with the drive magnet 25 which sets this stator group 10 and proper spacing, and counters, as shown in drawing 7 .
[0003] the Rota group 20 -- the upper limit section of a revolving shaft 21 -- press fit -- burning -- inserting in -- etc. -- it has the hub 22 of an abbreviation bell shape which fixed. This hub 22 is for carrying Disk D, and the above-mentioned drive magnet 25 is attached in the illustration lower limit side through the back yoke 35.
[0004] On the other hand, the stator group 10 has the stator core 16 which looped each salient pole section around the coil 17. This stator core 16 is attached in the periphery section of the approximately cylindrical bearing electrode-holder section 15 set up by the frame 11.
[0005] Moreover, the bearing sleeve 13 is attached in the inner circumference section of the bearing electrode-holder section 15. The radial bearing sections RBa and RBb as the bearing surface for dynamic pressure generating estrange to shaft orientations, and are formed in the inner skin of this bearing sleeve 13. And in case a revolving shaft 21 rotates, the pressure up of the lubrication fluids 5, such as oil which intervened between the opposed faces of a revolving shaft 21 and a bearing sleeve 13, is carried out in a pumping operation of the slot for dynamic pressure generating (not shown), and bearing of the rotation of the hub 22 attached in one is made free to the revolving shaft 21 and the revolving shaft 21 by the dynamic pressure generated with the activity of the lubrication fluid 5.
[0006] Moreover, press fit fixing of the thrust plate 26 which constitutes thrust dynamic pressure bearing is carried out at the point (illustration bottom section) of a revolving shaft 21. Furthermore, it is fixed to one opening edge of the approximately cylindrical bearing electrode-holder section 15 of a frame 11 by the mechanical coupling means of fixed screw 6 grade, and the counter plate 14 blockades the opening concerned at it. Moreover, in order to prevent leakage of the lubrication fluid 5, O ring 7 is made to be placed between joints, or it is closing with adhesives. The above-mentioned thrust plate 26 is put by the lower limit side of a bearing sleeve 13, and the inner base of a counter plate 14 through slight space, is further placed between these space by the lubrication fluid 5, and is supporting the revolving shaft 21 stably in the thrust direction based on the dynamic pressure generated with the activity of the lubrication fluid 5.
[0007]
[Problem(s) to be Solved by the Invention] However, if it is in the recent years when thin shape-

ization of a motor is demanded, in the conventional spindle motor, in junction to a revolving shaft 21 and a thrust plate 26, or junction to a revolving shaft 21 and a hub 22, sufficient junction die length cannot be secured but there is a problem that it is difficult to obtain the bonding strength which can bear desired shock-proof ability (more than 1000G [for example,]) and the external force at the time of assembly.

[0008] Moreover, although various junction methods of construction are adopted, in concluding using the fixed screw 6 as shown in drawing 7 in performing junction on a counter plate 14 and a frame 11, or junction to a counter plate 14 and a bearing sleeve 13, the head of the fixed screw 6 serves as evil of thin-shape-izing. Also when it fixes a counter plate 14 with a caulking method of construction, the caulking section must be made to project from the base of a counter plate 14, and it becomes the evil of thin-shape-izing too. Moreover, since sufficient junction die length is not obtained when it fixes a counter plate 14 with a press fit method of construction, bonding strength runs short.

[0009] When it explains more concretely, in the thin notebook computer which carried the conventional spindle motor as an object for a hard disk drive, there is a trouble that the shock resistance called for is unclearable. That is, with the notebook computer carried frequently, since the danger of making it falling is also high, advanced shock resistance is required, but when thin shape-ization is performed with the conventional spindle motor, the bonding strength of each above-mentioned joint becomes weak and a comparatively big external impact is added since sufficient junction die length is not obtained, the squareness of the hub 22 and thrust plate 26 to a revolving shaft 21 may deteriorate. Consequently, when a disk rotates, a deflection occurs, or there is a possibility that the situation of the rotation impossible of a disk may arise further. Moreover, when the bonding strength of a counter plate 14 is inadequate, there is also a possibility that lubricant 5 may leak out by the external impact.

[0010] Then, this invention is by raising the bonding strength of components with comparatively short junction die length to offer the spindle motor which can raise shock resistance demanded with a notebook computer etc., and its dependability, attaining thin shape-ization of a motor.

[0011]

[Means for Solving the Problem] In order to attain the above-mentioned purpose, the spindle motor concerning invention according to claim 1 The fixed frame which has a tubed attaching part, and the approximately cylindrical bearing sleeve which has dynamic pressure bearing and was attached in the inner circumference side at the above-mentioned tubed attaching part, The lubrication fluid held in this bearing sleeve, and the revolving shaft were inserted in the above-mentioned bearing sleeve and bearing of the rotation of was made free through the above-mentioned lubrication fluid, The hub which fixed to the end side of this revolving shaft, and the annular thrust plate which junction fixing is carried out at the other end side of the above-mentioned revolving shaft, and constitutes thrust dynamic pressure bearing, The above-mentioned bearing sleeve is equipped with the counter plate by which junction fixing was carried out so that opening of the above-mentioned bearing sleeve may be blockaded. While preparing the roll off which became depressed in shaft orientations, welding the above-mentioned revolving shaft and the above-mentioned thrust plate in this roll off and uniting both with the surface part of the junction boundary section of the above-mentioned revolving shaft and the above-mentioned thrust plate It is characterized by preparing the roll off which became depressed in shaft orientations, welding the above-mentioned bearing sleeve and the above-mentioned counter plate in this roll off, and coming to unite both with the surface part of the junction boundary section of the above-mentioned bearing sleeve and the above-mentioned counter plate.

[0012] By such configuration, since sufficient bonding strength can be obtained even if the junction die length of a revolving shaft and a thrust plate and the junction die length of a bearing sleeve and a counter plate are comparatively short, the shock resistance of motor confidence improves. Consequently, the squareness of the thrust plate to a revolving shaft is kept stable, and the dependability of a motor improves. And since the roll off which became depressed in shaft orientations is prepared in each junction boundary section, it welds in this roll off and both are unified, even if the building-up section is formed by joining, since that building-up section

escapes and is held in circles, the building-up section concerned does not check thin shape-ization of the whole motor. Furthermore, since the bearing sleeve and the counter plate are joined by welding, leakage of a lubrication fluid can be prevented certainly, without using an O ring and adhesives.

[0013] Moreover, the spindle motor concerning invention according to claim 2 A spindle motor according to claim 1 and the fixed frame which is an almost common configuration, It has a bearing sleeve, a lubrication fluid, a revolving shaft, a hub, and a thrust plate. Junction fixing is carried out at the above-mentioned tubed attaching part so that a counter plate may blockade opening of the tubed attaching part of the above-mentioned fixed frame. While preparing the roll off which became depressed in shaft orientations, welding the above-mentioned revolving shaft and the above-mentioned thrust plate in this roll off and uniting both with the surface part of the junction boundary section of the above-mentioned revolving shaft and the above-mentioned thrust plate It is characterized by preparing the roll off which became depressed in shaft orientations, welding the above-mentioned tubed attaching part and the above-mentioned counter plate in this roll off, and coming to unite both with the surface part of the junction boundary section of the above-mentioned tubed attaching part and the above-mentioned counter plate.

[0014] Therefore, the shock resistance of motor confidence improves, attaining thin shape-ization of a motor, since sufficient bonding strength can be obtained even if the junction die length of a revolving shaft and a thrust plate and the junction die length of the tubed attaching part of a fixed frame and a counter plate are comparatively short. Consequently, the squareness of the thrust plate to a revolving shaft is kept stable, and the dependability of a motor improves.

[0015] Moreover, in invention according to claim 3, it is characterized by for one of materials having fused at least in each above-mentioned junction boundary section, and having combined with the material of another side in the spindle motor according to claim 1 or 2.

[0016] Therefore, since association of the members in each junction boundary section is not based on a mechanical coupling means but is performed by metal melting association, both members can be combined very firmly. Moreover, although the amount of [of a revolving shaft and a thrust plate] bond part exists in a lubrication fluid, since it does not use organic solvents, such as adhesives, it does not produce the catalysis to a lubrication fluid and does not degrade the property of a lubrication fluid.

[0017] Moreover, in invention according to claim 4, it is characterized by the above-mentioned hub and the above-mentioned revolving shaft having fixed by welding in the spindle motor according to claim 1 to 3. Therefore, the bond strength of a hub and a revolving shaft increases and the shock resistance of the whole motor improves further.

[0018] Moreover, in invention according to claim 5, roll off which the slot for dynamic pressure generating is formed in the above-mentioned thrust dynamic pressure bearing of the above-mentioned thrust plate, and was formed in the junction boundary section of the above-mentioned revolving shaft and the above-mentioned thrust plate is characterized by being formed in the part from which it separated from the formation field of the above-mentioned slot for dynamic pressure generating in a spindle motor according to claim 1 to 4. Therefore, desired thrust dynamic pressure can be demonstrated, without the slot for dynamic pressure generating receiving a limit by roll off.

[0019] Moreover, the fixed frame which has a hole for axial immobilization in invention according to claim 6, The fixed shaft which the end was inserted in the above-mentioned hole for axial immobilization, and was fixed to the above-mentioned frame, The bearing sleeve which has dynamic pressure bearing in an inner circumference side, and was fitted in the above-mentioned fixed shaft, The lubrication fluid held in this bearing sleeve, and the hub were constituted in one with the above-mentioned bearing sleeve, and bearing of the rotation of was made free through the above-mentioned lubrication fluid, It has the annular thrust plate which junction fixing is carried out at the other end side of the above-mentioned fixed shaft, and constitutes thrust dynamic pressure bearing. It is characterized by having prepared the roll off which became depressed in shaft orientations, having welded the above-mentioned fixed shaft and the above-mentioned thrust plate in this roll off, and uniting both with the surface part of the junction

boundary section of the above-mentioned fixed shaft and the above-mentioned thrust plate.
[0020] Although above-mentioned claim 1 thru/or invention according to claim 2 relate to an axial rotation mold motor, invention according to claim 6 relates to an axial cover-half motor. By such configuration, since sufficient bonding strength can be obtained even if the junction die length of a fixed shaft and a thrust plate is comparatively short, own shock resistance of a motor improves. Consequently, the squareness of the thrust plate to a fixed shaft is kept stable, and the dependability of a motor improves. And since the roll off which became depressed in shaft orientations is prepared in the junction boundary section and both are unified by welding in this roll off, even if the building-up section is formed by joining, that building-up section escapes, is held in circles, and does not check thin shape-ization of the whole motor.
[0021] Moreover, in invention according to claim 7, roll off which the slot for dynamic pressure generating is formed in thrust dynamic pressure bearing of a thrust plate, and was formed in the junction boundary section of a fixed shaft and a thrust plate is characterized by being formed in the part from which it separated from the formation field of the slot for dynamic pressure generating in a spindle motor according to claim 6. Therefore, desired thrust dynamic pressure can be demonstrated, without the slot for dynamic pressure generating receiving a limit by roll off. In addition, in the above-mentioned junction boundary section, the fixed reinforcement of a fixed shaft and a thrust plate improves by one of materials' fusing at least and making it combine with the material of another side.
[0022]
[Embodiment of the Invention] Hereafter, it explains to a detail based on the gestalt of the operation which shows the configuration of this invention to a drawing.
[0023] [Gestalt 1 of operation] drawing 1 is the half section Fig. showing the spindle motor M1 concerning the gestalt 1 of operation of this invention. In drawing 1 , the spindle motor M1 concerned is the so-called axial rotation type of motor, and consists of a stator group 10 and a Rota group 20 including the revolving shaft 21 supported free [rotation] to this stator group 10. Among these, the stator group 10 has the fixed frame 11 by which a stop is ****ed and carried out to the drive chassis which omitted illustration. the bearing sleeve 13 formed in the inner circumference side of the tubed attaching part 12 formed so that it might set up into the abbreviation central part of this fixed frame 11 at the bell shape -- press fit -- burning -- inserting in -- etc. -- it is joined in one by the method of construction. In order that this bearing sleeve 13 may make processing easy, it is formed from a copper system metal or a stainless steel metal, to that inner circumference side, it passes, for example, and the slots RBa and RBb for radial dynamic pressure generating of a ring bone configuration separate into 2 blocks, and are cut in shaft orientations. These slots RBa and RBb for radial dynamic pressure generating constitute dynamic pressure bearing.
[0024] Moreover, the stator core 16 which looped around the coil 17 is attached in each salient pole at the periphery side of the tubed attaching part 12 of the fixed frame 11, and the armature is constituted by these coils 17 and the stator core 16.
[0025] Into the feed hole of the above-mentioned bearing sleeve 13, the revolving shaft 21 which consists of stainless steel which constitutes the Rota group 20 mentioned above is inserted free [rotation]. And the dynamic pressure side formed in the inner skin of a bearing sleeve 13 is carrying out contiguity opposite to the dynamic pressure side formed in the peripheral face of a revolving shaft 21. More, while opposite arrangement of the dynamic pressure side by the side of the bearing sleeve 13 in the slots RBa and RBb for radial dynamic pressure generating of the above-mentioned pair and the dynamic pressure side by the side of a revolving shaft 21 is carried out at the shape of a periphery through very small spacing which is several micrometers, the lubrication fluids 5, such as oil, a magnetic fluid, and air, are poured into the detail into the bearing space which consists of the very small spacing. If the Rota group 20 including a revolving shaft 21 rotates according to such bearing structure, the pressure up of the lubrication fluid 5 is carried out by pumping operation of the slots RBa and RBb for radial dynamic pressure generating, and dynamic pressure is produced with that activity, and it is constituted so that the Rota group 20 may rotate without nonuniformity with the dynamic pressure of this lubrication fluid 5.

[0026] In the end side of a revolving shaft 21, the abbreviation cup-like hub 22 in which record media, such as a magnetic disk, are carried has fixed with a junction means to mention later. The hub 22 has the disk loading side 24 in which it spreads outside from the lower limit side of the body 23 by which a disk is inserted in a periphery side, and this body 23, and a disk is carried. It is equipped with the annular drive magnet 25 by which multi-electrode magnetization was carried out, and the inner skin of this drive magnet 25 set the peripheral face of a stator core 16, and proper spacing in the inner skin of the body 23 of a hub 22, and has countered it. Here, since the hub 22 is formed of magnetic material, such as iron, it can operate hub 22 self as a back yoke of the drive magnet 25. Therefore, with this operation gestalt, since York of another components is omitted, as compared with the hub 22 where an outer-diameter dimension is equivalent, the building envelope of a hub 22, i.e., the space which arranges an armature, becomes large with the spindle motor M1 concerned. So, comparatively big motor torque can be acquired. In addition, when forming the above-mentioned hub 22 by non-magnetic materials, such as an aluminum containing alloy, York which consists of a magnetic material is made to intervene between a hub 22 and the drive magnet 25.
[0027] On the other hand, to the other end, i.e., illustration lower part, side of a revolving shaft 21, the disc-like thrust plate 26 has fixed with the below-mentioned junction means. The upper thrust dynamic pressure bearing SBa is formed of the dynamic pressure [by which this thrust plate 26 was cut in the central part by the side of the lower limit of a bearing sleeve 13] side in which it is arranged so that it may become depressed and may hold in section 13a, and a thrust plate 26 and the end face of a bearing sleeve 13 carry out contiguity opposite into hollow section 13a of that bearing sleeve 13 at shaft orientations.
[0028] Furthermore, as the dynamic pressure side of the illustration top of a thrust plate 26 was approached, the disc-like counter plate 14 more large-sized than the thrust plate 26 concerned has fixed with the below-mentioned junction means to lower limit side opening of a bearing sleeve 13. And the lower thrust dynamic pressure bearing SBb is formed of the dynamic pressure side established in the upper limit side of a counter plate 14, and the dynamic pressure side by the side of a thrust plate 14.
[0029] The dynamic pressure side by the side of the thrust plate 14 in the thrust dynamic pressure bearings SBa and SBb of the pair which adjoined and was arranged more in these shaft orientations by the detail, While opposite arrangement is carried out through very small spacing of several micrometers at shaft orientations, the bearing sleeve 13 which each counters these, and the dynamic pressure side of a counter plate 14 Into the bearing space which consists of the very small spacing, it is poured in so that the lubrication fluid 5 may follow shaft orientations through the path by the side of the periphery of a thrust plate 26.
[0030] furthermore, the dynamic pressure side of the above-mentioned thrust plate 26, and a bearing sleeve 13 and the dynamic pressure side of a counter plate 14 -- as [show / in one side at least / at drawing 3] -- it passes and the slots 261 for thrust dynamic pressure generating, such as the shape of the shape of a ring bone and a spiral, are cut annularly. And it is made by the configuration that the Rota group 20 including a revolving shaft 21 and a hub 22 is supported to revolve by the dynamic pressure of the slot 261 for thrust dynamic pressure generating in the thrust direction when a thrust plate 26 rotates with rotation of the Rota group 20.
[0031] Here, the joint structure of the revolving shaft 21 of a spindle motor M1 and thrust plate 26 concerning this operation gestalt is explained to a detail.
[0032] When the spindle motor M1 concerned is thin-shape-ized, for example, it designs in height of about 5mm, the bond length of a revolving shaft 21 and a thrust plate 26 is set to less than 1mm. Therefore, about both association, a press fit method of construction and since sufficient junction die length is not obtained even if it burns and inserts in and carries out only by the method of construction, bond strength will become weak. Temporarily, when many press fit cost is taken and is pressed fit, there is a possibility that the squareness of the thrust plate 26 to a revolving shaft 21 may deteriorate, and the press fit cost more than the specified quantity cannot be prepared. So, with this operation gestalt, after pressing fit or inserting a revolving shaft 21 and a thrust plate 26 in extent which degradation of the above-mentioned squareness does not produce, both junction boundary section is welded from the front-face side.

Under the present circumstances, the roll off 30 which became depressed in shaft orientations beforehand is annularly formed in the surface part of the junction boundary section concerned, and the revolving shaft 21 and the thrust plate 26 are welded in this roll off.
[0033] The configuration of the roll off 30 in the junction boundary section of a revolving shaft 21 and a thrust plate 26 is constituted by configuration which is illustrated to drawing 2 (a), (b), and (c). Namely, while taper side 21a is formed in the periphery edge by the side of the tip of a revolving shaft 21 over the perimeter, as for drawing 2 (a), inner skin 26a of the feed hole of a thrust plate 26 adjoins the above-mentioned taper side 21a. Therefore, the roll off 30 of a cross-section wedge shape is formed, and both are welded within this roll off 30. In addition, taper side 21a by the side of the tip of a revolving shaft 21 is functioning also as the guide section at the time of pressing a thrust plate 26 fit in a revolving shaft 21.
[0034] While taper side 21a is formed in the periphery edge by the side of the tip of a revolving shaft 21 over the perimeter, as for drawing 2 (b), taper side 26b is formed also in the inner circumference edge of the feed hole of a thrust plate 26. In the case of this gestalt, the cross-section triangle-like roll off 30 is formed, and both are welded within this roll off 30.
[0035] While taper side 21a is formed in the periphery edge by the side of the tip of a revolving shaft 21 over the perimeter, hollow 26c with the flat circumference of the feed hole in the bottom surface part of a thrust plate 26 is formed, 26d of taper sides is formed in the periphery, and, as for drawing 2 (c), the dynamic pressure side SBb is further formed in the outside. In the case of this gestalt, 30 is formed for the roll off of trapezoidal shape, and both are welded within this roll off 30.
[0036] In addition, the roll off 30 formed in the junction boundary section of a revolving shaft 21 and a thrust plate 26 is formed in the part from which it separated from the formation field of the slot 261 for dynamic pressure generating formed in the thrust plate 26 as shown in drawing 3 . Therefore, desired thrust dynamic pressure can be demonstrated, without the slot 261 for dynamic pressure generating receiving a limit by roll off 30.
[0037] Moreover, as long as a welding part is in roll off 30, it may weld the perimeter or may weld two or more places partially.
[0038] Although arc welding methods, such as a plasma-arc-welding method and a TIG-arc-welding method, the electron-beam-welding method represented by the laser-welding method are adopted as a welding operator method, in this operation gestalt, the laser-welding method which is made to carry out melting of the materials joined mutually, and joins both is used. This laser-welding method converges the laser beam emitted from a laser transmitter using two or more mirror planes, irradiates this at the junction boundary section, and joins both. Since the electrode used by the arc welding method is made unnecessary according to such an electron-beam-welding method, climax of the material in the junction boundary section can be suppressed to the minimum. Moreover, since the roll off 30 which became depressed in shaft orientations is formed in the junction boundary section even if slight climax arose, the building-up section is held in roll off 30, and can prevent projecting in a counter-plate 14 side rather than a dynamic pressure side. Therefore, when the Rota group 20 which the building-up section does not approach a counter-plate 14 side too much, and contains a thrust plate 26 rotates, it can prevent that the building-up section collides with the bearing surface of a counter plate 14. Moreover, although the amount of [of a revolving shaft 21 and a thrust plate 26] bond part exists in the lubrication fluid 5, since it has joined both by welding, without using organic solvents, such as adhesives, it does not produce the catalysis to the lubrication fluid 5, and does not degrade the property of the lubrication fluid 5.
[0039] Next, the joint structure of the bearing sleeve 13 of a spindle motor M1 and counter plate 14 concerning this operation gestalt is explained to a detail.
[0040] It returned to drawing 1 and the disc-like counter plate 14 has fixed to opening by the side of the lower limit of the bearing sleeve 13 formed in the shape of a cylinder. While the peripheral face is pressed fit in a bearing sleeve 13, as for a counter plate 14, the rim side of an upper limit side is in contact with step 13b of a bearing sleeve 13. Furthermore, the roll off 40 which became depressed in shaft orientations is formed in the surface part of the junction boundary section of a bearing sleeve 13 and a counter plate 14, and both are unified by welding

in this roll off 40. As a welding operator method, it is welded by the electron-beam-welding method represented by the laser-welding method like the junction method of construction of the revolving shaft 21 and thrust plate 26 which were mentioned above. Therefore, even if there are few bearing sleeves 13 and counter plates 14, one of materials fuses by the exposure of an electron beam, and both are joined.

[0041] Moreover, the configuration of roll off 40 may be a wedge, a triangle, a trapezoid, or other cross-section configurations as well as the **** configuration of the roll off 30 formed in the junction boundary section of the revolving shaft 21 and thrust plate 26 which were shown in drawing 2 . In addition, in order to make easy press fit or insertion of a counter plate 14, it is good for the inner circumference edge of opening of a bearing sleeve 13 to form taper-like guide section 13c. Moreover, since a welding part makes the above-mentioned opening seal, welding over the perimeter is desirable.

[0042] Thus, in the joint structure of a bearing sleeve 13 and a counter plate 14, since roll off 40 is formed in the junction boundary section, it welds within this roll off 40 and both are unified, even if the building-up section is formed by joining, thin shape-ization of the whole motor is not checked. Furthermore, since the bearing sleeve 13 and the counter plate 14 are joined by welding, leakage of the lubrication fluid 5 can be prevented certainly, without using an O ring and adhesives.

[0043] Next, the joint structure of the revolving shaft 21 of a spindle motor M1 and hub 22 concerning this operation gestalt is explained to a detail. As shown in drawing 1 , the junction die length of a revolving shaft 21 and a hub 22 is long compared with the junction die length of a revolving shaft 21 and a thrust plate 26, but if the height of the whole motor is shortened, the junction die length of a revolving shaft 21 and a hub 22 will also become short inevitably. Since the bonding strength of a revolving shaft 21 and a hub 22 falls in connection with this, with this operation gestalt, the revolving shaft 21 and the hub 22 have been joined by welding like the junction structure of the revolving shaft 21 and thrust plate 26 which were mentioned above.

[0044] When many press fit cost of a hub 22 to a revolving shaft 21 is taken and is pressed fit forcibly temporarily here, distortion arises in a hub 22 with press fit stress, and the squareness of the hub 21 to a revolving shaft 21 and the squareness of the disk loading side 24 of the hub [specifically as opposed to a revolving shaft 21] 22 will deteriorate, a disk is carried in a hub 21, and when a rotation drive is carried out, the deflection exceeding tolerance will occur.

[0045] So, with this operation gestalt, the roll off 50 which became depressed in shaft orientations is formed in the junction boundary section of a revolving shaft 21 and a hub 22, and both have joined by laser welding into this roll off 50. The above-mentioned roll off 50 is formed by taper side 21b formed in the corner by the side of the tip of a revolving shaft 21, and taper side 22b formed in the inner circumference edge of the axial mounting hole 28 of a hub 22. Among these, taper side 21b of a revolving shaft 21 functions also as the guide section at the time of pressing a hub 22 fit in a revolving shaft 21. In addition, in this operation gestalt, since the clamper guide section 29 for guiding the clamper (not shown) for holding a disk to the upper limit side of a hub 22 projects to shaft orientations slightly and is prepared in them rather than the junction boundary section of a revolving shaft 21 and a hub 22, even if it does not form roll off 50, thin shape-ization of a motor is not checked. Moreover, a welding part may be welded over the perimeter of the junction boundary section, or may be divided and welded to two or more places.

[0046] Since both bonding strength can fully be raised, while the shock resistance of a motor improves according to the above junction structures, without pressing a revolving shaft 21 and a hub 22 fit forcibly, the squareness of the disk loading side 24 of the hub 22 to a revolving shaft 21 is maintainable with high precision.

[0047] [Gestalt 2 of operation] drawing 4 is the half section Fig. showing the spindle motor M2 concerning the gestalt 2 of operation of this invention. In drawing 4 , the same sign is attached to the configuration of the spindle motor M1 concerning the gestalt 1 of operation shown in drawing 1 , and a common function, and the detailed explanation is omitted.

[0048] The stator core 16 which looped around the coil 17 is attached in the periphery side of tubed attaching part 12' set up in the center of the fixed frame 11. Rather than the tubed

attaching part 12 which showed this tubed attaching part 12' to drawing 1 , it is formed in shaft orientations for a long time, and the bearing sleeve 13 and the counter plate 14 are being fixed to that inner circumference side. That is, although the counter plate 14 was joined to opening of a bearing sleeve 13 in the gestalt 1 of operation, with the gestalt 2 of this operation, the counter plate 14 is joined to opening of tubed attaching part 12' of the fixed frame 11.
[0049] In joining a counter plate 14 to tubed attaching part 12', the roll off 40 which became depressed in shaft orientations is formed, a counter plate 14 and tubed attaching part 12' are welded in this roll off 40, and both are united with both junction boundary section. As a welding operator method, although an arc welding method and an electron-beam-welding method are adopted as mentioned above, even if there are little counter plate 14 and tubed attaching part 12', melting of either is carried out and both are joined by the electron-beam-welding method preferably represented by laser welding. Thus, since forming the part which projects rather than the fixed frame 11 or the base of a counter plate 14 by joining both into roll off 40 is lost, thin shape-ization of a motor is not checked. in addition -- and since the fixed frame 11 and a counter plate 14 are firmly joined by welding, shock resistance improves. Moreover, the revolving shaft 21 and the thrust plate 26 are joined like the gestalt 1 of above-mentioned operation. That is, while the end of a revolving shaft 21 is pressed fit in the central hole of a thrust plate 26, roll off 30 is formed in the junction boundary section of a revolving shaft 21 and a thrust plate 26, and both are unified by welding in this roll off 30. As for this welding, it is desirable to use electron-beam-welding methods, such as laser welding.
[0050] Furthermore, the junction to a revolving shaft 21 and a hub 22 forms roll off 50 in the junction boundary section of a revolving shaft 21 and a hub 22, and is making both unify by welding in this roll off 50 like junction to a revolving shaft 21 and a thrust plate 26 while it presses a revolving shaft 21 fit in the central hole of a hub 22. In addition, this roll off 50 may be omitted depending on the configuration of a hub 22.
[0051] As mentioned above, since according to the spindle motor M2 of the gestalt 2 of operation sufficient bonding strength can be obtained even if the junction die length of a revolving shaft 21 and a thrust plate 26 and the junction die length of tubed attaching part 12' of the fixed frame 11 and a counter plate 14 are comparatively short, the shock resistance of motor confidence improves. Consequently, the squareness of the thrust plate 26 to a revolving shaft 21 is kept stable, and the dependability of a motor improves. And since the roll off 30 and 40 which became depressed in shaft orientations is formed in each junction boundary section, it welds in this roll off 30 and 40 and both are unified, even if a lobe is formed by joining, thin shape-ization of the whole motor is not checked. Moreover, since the revolving shaft 21 and the thrust plate 26 are joined by welding, the catalysis to the lubrication fluid 5 is not produced and the property of the lubrication fluid 5 is not degraded. Furthermore, since tubed attaching part 12' and a counter plate 14 are joined by welding, leakage of the lubrication fluid 5 can be prevented certainly, without using an O ring and adhesives.
[0052] [Gestalt 3 of operation] drawing 5 is the half section Fig. showing the spindle motor M3 for HDD concerning the gestalt 3 of operation of this invention. Although the spindle motors M1 and M2 shown in the gestalt 1 of operation mentioned above and the gestalt 2 of operation are the so-called axial rotation mold motors, the spindle motor M3 concerning the gestalt 3 of operation is an axial cover-half motor.
[0053] In drawing 5 , the outline configuration of the spindle motor M3 is carried out from the stator group 10 and the Rota group 20. Among these, the stator group 20 has the fixed frame 11 with which the tubed attaching part 12 was set up by the abbreviation central part in one, and the stator core 16 which looped around the coil 17 is attached in the peripheral face of this tubed attaching part 12.
[0054] Moreover, it is fixed to axial fixed hole 11a of the fixed frame 11 so that the fixed shaft 18 may project toward the upper part. The bearing sleeve 13 which constitutes the Rota group 20 is inserted in the periphery side of this fixed shaft 18 pivotable. Furthermore, the hub 22 for carrying record media, such as a magnetic disk, is joined to the periphery side of a bearing sleeve 13. namely, -- the upper limit part of a bearing sleeve 13 -- the method side of the outside of radial -- going -- a collar -- the junction hole by which the major diameter 131 formed in the **

was formed, and penetration formation was carried out to the peripheral face of this major diameter 131 in the core of said hub 22 -- press fit -- or -- burning -- inserting in -- it is joined in one. Moreover, the hub 22 has the disk loading side 24 for jutting out of the peripheral face of a body 23 and this body 23 outside, and carrying a disk. The inner skin of a body 23 is equipped with the annular drive magnet 25 through the back yoke 35, and the inner skin of this drive magnet 25 set proper spacing to the peripheral face of the above-mentioned stator core 16, and has countered it.

[0055] On the other hand, in order that a bearing sleeve 13 may easy-ize that processing, it is formed from the copper system metal or the stainless steel metal, and the radial dynamic pressure bearings RBa and RBb of a pair make predetermined spacing to shaft orientations, and it is formed in the inner skin of the feed hole established in this bearing sleeve 13. Into the very small clearance between the inner skin of a bearing sleeve 13, and the peripheral face of the fixed shaft 18, the lubrication fluids 5, such as oil, a magnetic fluid, and Ayr, are poured in. And the slot for radial dynamic pressure generating of the shape for example, of a herringbone of both the dynamic pressure side of a bearing sleeve 13 and the fixed shaft 18 which omitted illustration to one side is cut at least. Therefore, if a bearing sleeve 13 rotates with rotation of the Rota group 20, the pressure up of the lubrication fluid 5 is carried out by pumping operation of the slot for radial dynamic pressure generating, dynamic pressure is produced, and it is made by the configuration that a hub 22 is supported to revolve by the dynamic pressure in a radial direction.

[0056] Furthermore, it has fixed with the junction means which the disc-like thrust plate 26 mentions later, a part for a tip flank, i.e., the illustration upper limit part, of the fixed shaft 18. The lower thrust dynamic pressure bearing SBa is formed of the dynamic pressure [by which this thrust plate 26 was cut in a part for the core by the side of the illustration upper limit of a bearing sleeve 13] side in which it is arranged so that it may become depressed and may hold in circles, and a thrust plate 26 and the end face of a bearing sleeve 13 carry out contiguity opposite in those hollow circles at shaft orientations.

[0057] As the dynamic pressure side of the illustration top of a thrust plate 26 was approached, the counter plate 14 has fixed into the upper limit part of the above-mentioned bearing sleeve 13 further again. And the upper thrust dynamic pressure bearing SBb is formed of the dynamic pressure side by the side of the illustration lower limit side of a counter plate 14, and the dynamic pressure side of a thrust plate 26. The slot for thrust dynamic pressure generating of the shape of the shape of a spiral and a herringbone is formed in the thrust dynamic pressure bearing SBb by the side of besides, and the lower thrust dynamic pressure bearing SBa, respectively. Therefore, if a thrust plate 26 rotates with rotation of the Rota group 20, the pressure up of the lubrication fluid 5 is carried out by pumping operation of each above-mentioned slot for thrust dynamic pressure generating, dynamic pressure is produced, and it is made by the configuration that a hub 22 is supported to revolve by the dynamic pressure in the thrust direction.

[0058] Here, the junction structure of the fixed shaft 18 and thrust plate 26 in this operation gestalt is explained. After inserting the bearing sleeve 13 united with the hub 22 to the fixed shaft 18 set up by the fixed frame 11, the annular thrust plate 26 is pressed fit in the fixed shaft 18 with moderate insertion pressure. Both are joined by welding the junction boundary section of the fixed shaft 18 and a thrust plate 26 after an appropriate time. As shown in drawing 6 , the roll off 30 which became depressed rather than the dynamic pressure side is annularly formed in the feed-hole periphery which hits the junction boundary section by the side of a thrust plate 26. This welding has a desirable laser-welding method of construction, and the thrust plate 26 which becomes [metal / a copper system metal or / stainless steel] clitteringly with the method of construction concerned fuses it, and it is carrying out metal melting association with the fixed shaft 18. Even if a local lobe arises by a line crack and welding within the above-mentioned roll off 30, welding with the fixed shaft 18 is constituted so that it may not project from a dynamic pressure side.

[0059] By such configuration, since sufficient bonding strength can be obtained even if the junction die length of the fixed shaft 18 and a thrust plate 26 is comparatively short, own shock

resistance of a motor improves. Consequently, the squareness of the thrust plate 26 to the fixed shaft 18 is kept stable, and the dependability of a motor improves. And since the roll off 30 which became depressed in shaft orientations is formed in the junction boundary section and both are unified by welding in this roll off 30, thin shape-ization of the whole motor is not checked. Moreover, since the junction boundary section located so that the lubrication fluid 5 for generating dynamic pressure may be touched is welded, the catalysis to a lubrication fluid is not produced and the property of the lubrication fluid 5 is not degraded.

[0060] As mentioned above, although the operation gestalt of invention made by this invention person was explained concretely, it cannot be variously overemphasized in the range which this invention is not limited to the above-mentioned operation gestalt, and does not deviate from the summary that it is deformable.

[0061] For example, in the above-mentioned operation gestalt 1 or 2, the example joined by welding was shown so that a counter plate 14 might blockade opening of tubed attaching part 12' of a bearing sleeve 13 or the fixed frame 11, but while securing bonding strength by welding a part of junction boundary section, the perimeter of the junction boundary section may be closed with adhesives. Thereby, leakage of a lubrication fluid can be prevented certainly.

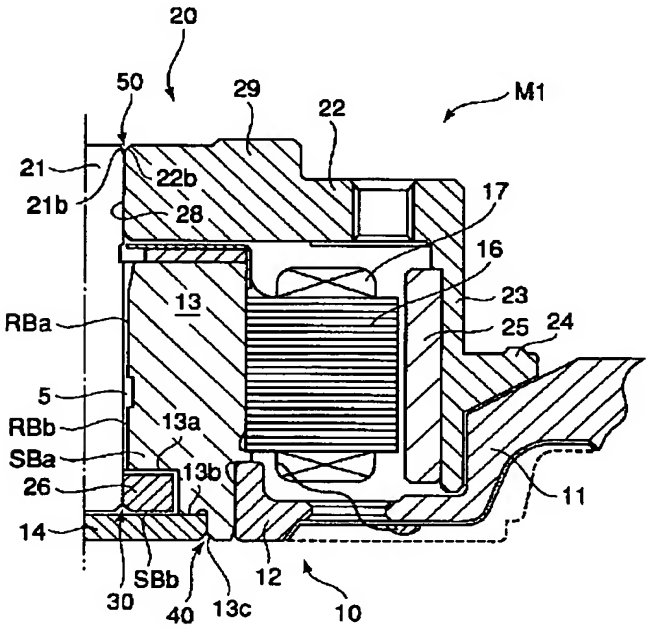
[0062] Moreover, this invention is applicable similarly to spindle motors other than for [which was mentioned above] a hard disk drive, for example, the motor for a CD-ROM drive, and the motor for a polygon mirror drive.

[0063]

[Effect of the Invention] Since according to this invention roll off is prepared in the junction boundary section of a revolving shaft and a thrust plate and the junction boundary section of a bearing sleeve and a counter plate, or the junction boundary section of a fixed frame and a counter plate, and each member is welded and it is unifying in this roll off so that more clearly than the above explanation, even if the junction die-length junction die length of each part material is comparatively short, sufficient bonding strength can be obtained, and the shock resistance of motor confidence improves. Consequently, the squareness of the thrust plate to a revolving shaft is kept stable, and the dependability of a motor improves. And even if a lobe is formed by joining, thin shape-ization of the whole motor is not checked. Furthermore, since the bearing sleeve and the counter plate are joined by welding, leakage of a lubrication fluid can be prevented certainly, without using an O ring and adhesives. Moreover, since the junction boundary section of the revolving shaft and thrust plate which are located so that the lubrication fluid for generating dynamic pressure may be touched is welded, the catalysis to a lubrication fluid is not produced and the property of a lubrication fluid is not degraded.

[Translation done.]

Drawing selection Representative drawing



[Translation done.]